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# DOCUMENTING EARLY LITHIC TECHNOLOGIES IN SOUTH AMERICA*

## *DOCUMENTANDO LAS TECNOLOGÍAS LÍTICAS TEMPRANAS EN SUDAMÉRICA*

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The papers published here provide very fine, richly detailed and interpretively well-grounded information on research into early lithic industries in various parts of South America. They display a strong multidisciplinary approach, going beyond traditional typological concerns, to understanding how lithics can be used, with many other kinds of evidence, to interpret changing occupations over time in each research area. A wealth of important information has been presented on Late Pleistocene/ Early Holocene South American occupations in recent years, and below I suggest ways the primary data being generated can be made more widely and openly accessible. Indeed, local researchers are doing just that with radiocarbon evidence, and expanding the effort to include a wide array of data categories, including lithic artifacts on a continental scale, will be of comparable importance.

I have a number of general observations. First, I am impressed by the diversity in stone tool industries present among the earliest occupations in South America. In North America the seemingly uniform Clovis culture is widespread by ca. 13,000 years ago (Miller and Holliday 2013; Tankersley 2004), while in South America a number of bifacial and non-bifacial industries are present by this time or soon after. Of course, how uniform North American Clovis culture actually was is highly debatable (e.g., Haynes 2004; Meltzer 2009), and I suspect our ideas will change as we look beyond the presence of biface manufacturing styles like fluting to exploring, and most critically *comparing*, what people were actually doing in specific subregions and over time. In this regard, the similarity of one artifact category, fluted bifaces, over large areas has likely caused North American archaeologists to overlook or underestimate differences in other aspects of life. South American archaeologists, the papers herein demonstrate, have not been so shackled.

Widespread human settlement is evident over both North and South America at about the same time, however, about 13,000 years ago, and a great deal of professional energy is being directed to finding and understanding the earlier occupations from which these later populations emerged. This is a slow and sometimes contentious process in both continents, but the breadth and quality of research that is occurring is encouraging, and I do not think we will have to wait very long for answers about when and how people arrived and moved through the Americas. The apparent absence of continent or even regional wide diagnostic markers for occupations *predating* ca. 13,000 cal yr BP anywhere in the Americas, however, makes identifying early occupations challenging. In the southeastern United States we are lucky in that we have an unbroken 13,000 year sequence of temporally sensitive biface types, often with manufacturing ranges known to within a few centuries at most. The early South American record, like that in Australia, however, shows that such temporally sensitive diagnostics are not always evident or ubiquitous, however much we may actively look for them or want them to occur.

As the papers here show, researchers have moved well beyond a concern with describing stone tool industries to trying to understand the range of activities they were used for, and how these kinds of artifacts can be used to infer broader patterns of mobility, interaction, and change through time. The great diversity in early South American lithic industries is in marked contrast to the situation in North America during the Clovis period, dated to

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ca. 13,250-12,850 cal yr BP (Waters and Stafford 2007), when one technology seemingly occurs widely. It is paralleled by the diversity of regional and subregional traditions that occurs following Clovis in North America, during the Younger Dryas. Why broad cultural horizons occur and then fragment has been linked to changes in climate and adaptation, increasing population levels and concomitant restrictions in mobility, or even stylistic drift, but we have a long way to go to understand how and why such differentiation occurs. We will need better empirical data –evidence from well dated archaeological sites– to understand how long it takes populations settling into empty landscapes to achieve widespread archaeological visibility. We know human population increase can occur rapidly, but did it in the Late Pleistocene, at what rates, and over how long an interval? South America offers a remarkable laboratory to explore such questions, and help us better understand the human colonization and settlement of continental land masses in other parts of the world, such as in Australia, Europe, and North America.

Examining the settlement of the Americas can't remain focused in one area, but must take into account archaeological evidence across large areas, and ultimately from across the hemisphere. To do this will involve making the vast amount of well documented artifact, radiocarbon, and paleosubsistence data our profession has been collecting more readily accessible to researchers and the public alike, so they can appreciate it, work with it and contribute to it, and come up with new ideas and interpretations. A radiocarbon database for South America is now being developed, compiling earlier efforts, and individual datasets are available from many countries both in published form and in associated online supporting materials (e.g., Aceituno et al. 2013; Bueno, Prates et al. 2013; Bueno, Dias and Steele 2013; Capriles and Albarracin-Jordan 2013; Cooke et al. 2013; López Mazz 2013; Martínez et al. 2013; Méndez 2013; Prates et al. 2013; Rademaker et al. 2013; Steele and Politis 2009). The same thing is needed for artifact and assemblage information, and all of these various files should be linked and indexed. Publishing or posting information, be it radiocarbon dates, or images and measurement/attribute data on individual artifacts or collectively for assemblages, makes them available to a wide array of researchers, and to the general public, who shape the support our profession receives through their interest, appreciation, and political action. Online access also helps educate people, including other archaeologists, about the archaeological record in particular areas, and collectively over much larger regions. Having a variety of people examining and thinking about, as well as contributing primary data, means many perspectives and approaches will be in play. It also simplifies archaeological education most of us would like to know what these artifacts look like and their range of variation, and where they occur on the landscape, without having to sort through a myriad of publications.

I would thus urge the people in the South American archaeological research community, following upon their exemplary work with radiocarbon dates, to set up an online database much like I and my colleagues have tried to do in North America, with PIDBA, the Paleoindian Database of the Americas, available online at http://pidba.utk.edu/ (e.g., Anderson 1990, 2009:206-212; Anderson, Miller et al. 2010; Anderson et al. 2015). More importantly, it need not have everything in one place or under one format. Distributed networking and information sharing among many individuals and research teams is the future of scientific research. That is, providing links to separate databases, and indices and search capabilities to data within them, rather than insisting everyone conform to one standard, allows for greater diversity and approaches in research. Such an online framework should include as many kinds of data as possible, and not just bifaces or projectile points, but include other artifact and data categories. Ideally it should include or have links to associated paleosubsistence, paleoenvironmental, and bioarchaeological evidence, to facilitate multidisciplinary investigations. PIDBA includes lists of radiocarbon dates and report references, for example, as well as links to many other web sites holding primary data. A comparable effort could be established in South America, building on the impressive effort that went into the generation of the radiocarbon databases from individual countries.

While I made provisions to include data from South America in PIDBA, this effort never went very far, because our effort was focused on North America, where most of our team members knew people, sites, and assemblages far better than we did in Central and South America. I am now fully convinced that archaeological databases have to be home grown efforts, or at least have a substantial commitment from local specialists. These compilations have to be assembled and checked for accuracy by the people who are the most knowledgeable of the local archaeology and technical literature, and who have widespread personal contacts among those maintaining collections and records. Database construction thus starts locally, but it is also a team effort, and requires collaboration and a willingness to share information. The data in PIDBA, for example, has been provided by over 100 people to date, all of whom are aware that the data they provided is publically available, albeit with sensitive locational and ownership information removed. PIDBA is voluntarily maintained, with most data compilation handled by local avocational or professional archaeologists, and most of the data entry -where it is not already available electronically, which is uncommon in most older work- and posting by undergraduate and graduate students. Perhaps the most time consuming effort involves developing partnerships, that is, getting people to find, compile, and contribute data in areas where it is lacking.

Because PIDBA is online, anyone can use it, from enthusiastic undergraduates to graying senior professionals, rich or poor, young or old. The ethos of data sharing and cooperation such collaborative efforts bring about helps bind the widely scattered research community developing and using PIDBA together. Of course, it is critical to have arrangements in place for the long term curation of the digital data in a secure repository capable of maintaining it and migrating it to new platforms. Just because something is on a DVD or flash drive or is posted on the web now doesn't mean it will last forever. Repositories like tDAR and Open Context are dedicated to long term digital curation, and many university library systems have provision for such storage. Ultimately, however, the data in such repositories has to be accessible, that is, the data within them should be easy to find, examine, and use.

One way of linking archaeological data together that a number of colleagues and I are exploring makes use of site numbers as basic identifiers, working with information stored using those numbers in a variety of U.S. state repositories. DINAA, or the Digital Index of North American Archaeology (http://ux.opencontext.org/blog/archaeology-site-data/) is a multi-institutional collaboration developing online methods of linking archaeological data from multiple sources and making it readily accessible to researchers (Wells et al. 2014). Started in 2011, DINAA is a publicly accessible compilation of existing archaeological site file and other linked data, with open standards and licensing, transparent version control of both data and source code, linked data, and iterative development. It is maintained by Open Context (http://opencontext.org/), which has been referenced as a repository for archaeological data in data management plan guidelines by the US National Science Foundation. DINAA strictly conforms to legal requirements regarding the maintenance and use of cultural resources data, with primary data maintained and examined in secure encrypted offline storage. Public data presentation and display, as with PIDBA, is only available at low (e.g., 20km or sometimes county level) resolution, with all sensitive locational and other data stripped out. To date information from nearly half a million sites from 15 states in eastern North America has been linked together, and information about these sites, including distributional maps of indexed sites by time period, is available online. The DINAA team is currently working on indexing data listed by site number from PIDBA, tDAR, and other large scale datasets or data repositories, so researchers can learn where information is maintained, although direct access remains in the hands of the primary repository and database managers.

When information is compiled at large scales, important discoveries can occur, such as patterns unrecognized at smaller scale. Indeed, finding, compiling, and working with the massive amounts of archaeological data that have been generated is one of the greatest challenges facing archaeology in the 21$^{st}$ century, with arguably the greatest payoffs if resolved successfully (Kintigh et al. 2014:19). In southeastern North America, for example, archaeologists thought they knew the geographic extent of many Paleoindian point forms, but when the artifacts were compiled and plotted, the distributions were sometimes appreciably different. Thus point types thought to occur only in Florida, like Suwannee or Simpson, or in the central part of the region, like Redstone or Cumberland, actually occur much further away, to along the eastern seaboard (Anderson, Miller et al. 2010:72, 75-78; Anderson et al. 2015:33). We are developing the capability to produce many such maps of site or artifact distributions for much of eastern North America using DINAA, and are only beginning to explore the potential of this kind of information. Knowing where early sites and assemblages are found and what their environmental associations are is important, as well as where they do not occur, since this kind of information permits the monitoring of changes in adaptation and land use over time.

In the southeastern US many waisted, eared, and even fishtail looking points have been reported, for example, closely resembling forms found in South America (Faught 2006; see also the paper by Hermo, Terranova, and Miotti herein). Morphological similarity does not, of course, demonstrate cultural identity or contact, but the possibility can be evaluated scientifically as we compile measurement and photographic data from larger samples of these artifacts. There was probably a great deal more interaction around the Gulf of Mexico from northern and eastern South American and the Southeastern United States than we have tended to assume, and that it likely wasn't all one way, such as people and ideas moving from north to south. The Gulf of Mexico was far smaller when sea level was much lower, with greater connections between land masses, and shorter open water gaps (Anderson, Yerka and Gillam 2010). This is part of a much larger issue where archaeology has much to contribute, and that is how human cultures respond to changes in sea level change, and South America offers a vast and well documented early coastal archaeological record to bring to bear on this question. In colonization studies we sometimes focus on how people got to a place instead of what they did along the way, or even once they settled in. Our movement arrows depicting colonization routes aren't showing places groups passed through hoping to get somewhere else, but encompass areas people lived and died in, probably for a long time in resource rich areas.

The papers herein provide excellent summary information and illustrations of fieldwork, absolute dates, lithics, and other materials from early sites in several parts of South America. Skarbun, Cueto, Frank, and Paunero document lithic raw material selection and production sequences at the Cueva Túnel site, a stratified, well excavated and dated assemblage, as well as analyses of how the tools found there were used. Their analysis proceeded from the artifact to the site level, reconstructing how raw materials were selected and artifacts were made, used and discarded. Suarez's fieldwork and analysis of materials from at Pay Paso I is likewise superb. The field photographs are impressive, as were those of the artifacts, and indeed all the illustrations in this collection set a high standard. The large numbers of internally consistent radiocarbon dates from Pay Paso I provide precise dating of the deposits and associated artifacts, and serve as a textbook example of the value of obtaining multiple AMS determinations whenever possible. The site is important for offering stratigraphic and absolute dates for Tigre and Pay Paso point types, and for documenting associated tool forms. Blade technology is present, and does not appear to represent a northern intrusion, but a local development; as Suarez notes, people developed blade production technology in many parts of the world.

César Mendez and Donald Jackson explore alternatives to typological and descriptive approaches to data collection and interpretation, using information from multiple sources. Four well collected and dated deposits, from the classic sites as Taguatagua 1 and 2, Valiente, and Quebrada Santa Julia, are described and examined in terms of determining patterns of land use by some of the earliest known peoples in the Chilean coastal region. The focus by these early peoples on high quality lithic raw materials may have been for functional reasons, to conserve toolstone and extend use life. But these materials, and particularly translucent quartz crystal, which is found in some incidence, may have had symbolic value as well, by virtue of their unusual appearance. Acquiring extralocal or unusual lithic materials facilitates interaction by low density populations, by forcing them to move over the landscape, and hence increase their likelihood of meeting other peoples. Quartz, while uncommon in Clovis assemblages in North America, is not unknown, and appears to have been prized for its unusual appearance (Speth et al. 2013). Of 3439 Clovis points currently recorded in the southeastern U.S. in PIDBA for which raw material has been identified, in fact, 184 are made on quartz, or about 5% of the total, and 80 of these were made from clear crystal, indicating the material had some significance to local populations (Anderson 2013:380-381). Not all Paleoindian tools were functional, as we know from the occurrence of Clovis and later Dalton points in caches and in hypertrophic form (Huckell and Kilby 2014; Kilby 2015; Morse 1997; Walthall and Koldehoff 1998). Indeed, their manufacture was, at least in some cases, probably more about maintaining a cultural tradition, promoting ceremony, and creating and continuing bonds between groups than creating tools for everyday use.

Aceituno and Rojas-Mora document Late Pleistocene and Early Holocene assemblages in

Columbia, indicating early settlement of the interior occurred along the Magdalena river valley and on the Sabina de Bogata Andean plateau to the east. This pattern of early settlement in the interior may help explain one surprising and indeed for many years quite puzzling result of a least coast pathway analysis of colonization routes into South America (Anderson and Gillam 2000). Starting from the north in Panama, the analysis indicated movement into the continent could have occurred east of the Andes, and not along the Pacific coast (see also Sauer 1944 and Magnin et al. 2012 for similar interpretations). The occurrence of great linguistic diversity in the general region, and archaeological evidence suggesting dispersals along large river systems like that provided by Aceituno and Rojas-Mora herein, provide some support for this possibility (see also Aceituno et al. 2013; Dahl et al. 2011; Dias and Bueno 2013:348-350; Miotti and Magnin 2012). Given fluctuations in sea level that were occurring during the Late Pleistocene, the coastline may have been perceived as an unstable environment, at least during some periods (Anderson et al. 2013; Anderson and Bissett 2015). The landscape of interior Columbia would appear to be an excellent place to look for early, and perhaps some of the earliest, sites in South America.

Hermo, Terranova, and Miotti provide excellent documentation of the variability in fishtail projectile points from the Rio Negro province of Argentina, based on attribute data from a large sample of artifacts. The primary measurement data for each of these artifacts, ideally accompanied by photographs of each, is exactly the kind of information that needs to be made available in an online public database devoted to early assemblages from the continent. Our understanding of the variability in early assemblages can only grow when such data are available for examination from increasing numbers of sites and areas. Indeed, appreciable insight about geographic variation in artifact morphology has been gained from analyses employing large samples of Pleistocene artifacts from eastern North America (O'Brien et al. 2001; 2014). Artifact samples from South America have been used in a hemispherical scale analysis of biface morphological variability, and while the sample from the continent was small (n=61 points), it yielded important insights (Morrow and Morrow 1999). Whenever such analyses are published, especially if summary instead of individual measurements are given, where the primary data is curated should also be presented, that is, where the artifacts may be found as well as the measurement data itself. Making this kind of data accessible is one of the quickest ways I know to build a continental scale database, and at the same time ensure that a researcher's contributions are used over and over again. Much of the individual artifact attribute data now in PIDBA, in fact, came from people invested in an ethos of data sharing and open science. That spirit is alive and well in the archaeological community in South America, as evidenced by the radiocarbon databases that have been developed in recent years.

As a final observation, I agree with Franco who noted in her original comments that whenever possible we should use chronological or period terminology rather than cultural phase or stage names when reporting assemblages. In North America I have long argued that Pleistocene archaeological sites and assemblages should be grouped by period. In a framework I have proposed for Eastern North America for some 15 years now, Early Paleoindian corresponds to assemblages >13,250 cal yr BP., Middle Paleoindian from 13,250-12,850 cal yr BP, and Late Paleoindian from 12,850-11,700 cal yr BP, the latter corresponding to the Younger Dryas (Anderson 2001:152-156; Anderson and Sassaman 2012:5; Anderson et al. 2015:8-9; see also Waters and Stafford 2013 who argue for a similar arrangement, with their Early Paleoindian Pre Clovis era known as the 'Exploration' period).

In conclusion, these papers, and the many more like them that are appearing every year, convince me that Pleistocene archaeology in South America is in superb hands, and that some of the best thinking, field research, and analysis on the peopling of the Americas is occurring on that continent. Indeed, if we are to understand how the peopling of the Americas occurred, we can't look at individual areas, regions, or even continents in isolation, but need to devote our efforts to learning what is going on concurrently across the hemisphere.

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